ELECTRONIC DATA EXCHANGE

Automated Electronics Manufacturing

Project Leader: James A. St. Pierre

Staff: 4.0 Professionals

Funding level: $1.35 M

Funding sources: NIST (89%), Other (11%)

Objective: Develop tools for the electronics industry to facilitate the exchange of product data. This includes supporting the development of harmonized standards to enable accurate translation of electronic part and product data between standards, developing technology to permit data exchange of electronic component information, and developing certification and conformance testing methods for object oriented software for the semiconductor industry.

Background: To implement new management strategies such as total-quality-management, flexible manufacturing, cooperative development, and concurrent engineering, manufacturers need several types of data in computer-accessible digital formats that can be shared among them, and between them and their suppliers. These product standards and specifications are integral to the electronics industry to enable the design, manufacture, documentation, procurement, and support of modern electronics.

The traditional forums for capturing designs and manufacturing information—engineering drawings and paper specifications—are being replaced by digital formats. This information must be correct, complete, unambiguous, and efficient. According to the Institute for Interconnecting and Packaging Electronic Circuits (IPC), National Technology Roadmap for Electronic Interconnections, “The transfer from design to manufacturing is done by a machine language that was never intended to convey design information.” This summarizes a large problem facing the electronics industry today, in that a large amount of time is wasted as manufacturers wrestle with ambiguities in design files. Also according to the roadmap, “Most jobs (upwards of 70%) coming into a printed wiring board fabricator or assembler lack complete information.” Among the technical challenges is the development of adequate information models and standards that describe the essential characteristics of electrical and electronic products.

As a neutral third party, NIST is uniquely positioned to develop and demonstrate non-proprietary solutions and information models. Also, NIST's long involvement with voluntary standards organizations permits us to contribute effectively to the development of compatible standards.

Current Tasks:

1. Provide support for International Design Automation Standards to create a consistent method for representation of electronic part/product data

FY 1991	Completed determination of data requirements necessary to manufacture, test, and ship Hybrid Microelectronic Assemblies; Shifted the focus of the activity to developing an Initial Graphics Exchange application protocol as the deliverable.
FY 1992	Participated in a workshop on the harmonization of digital product data sponsored by the American National Standards Institute; Developed a first-draft harmonized model for net list connectivity and defined about 20 terms associated with the model.
FY 1993	Established multi-platform automation testbed to support the development of solutions to interoperability problems among computer aided design tools and electrical/electronic product data exchange standards.
FY 1994	Developed software to exercise the robustness of emerging Application Protocol (AP) 210, "Printed Circuit Assemblies;" Chaired Working Group 5, Test, Validation, Conformance and Qualification Support of Technical Committee 93 of the International Electrotechnical Commission; Completed and delivered draft of "Layered Electrical Products" application protocols to a committee developing the Initial Graphics Exchange specifications.
FY 1995	Contributed to the Electrical/Electronic design team effort of PDES, Inc., to complete Committee Draft version of Application Protocol 210, and submit it for approval as an ANSI standard; Developed automated electronic change control procedure for the components of the Initial Graphics Exchange Specifications and documented procedures in a NIST report.
FY 1996	Convened meetings of International Electrotechnical Commission working group to review existing standards for certification and conformance methodologies and define methodology requirements for all new standards submitted; Developed prototype library of layered electrical product object definitions and relationships; Reviewed compatibility of application protocols in the standard for the Exchange of Product Model Data with other electronic design standards and suggested modifications to resolve interoperability concerns.
FY 1997	Conclude review and development of the application protocol for printed circuit assemblies as it becomes an International Standard; Review conformance methodologies relevant to the electronics industry; Convene meetings and develop proposals for the International Electrotechnical Commission working group on test, validation, conformance and certification of standards related to electronics industry.
FY 1998	Publish conformance methodologies report to transfer techniques to industry.

2. Develop tools to facilitate Electronic Commerce of Component Information.

FY 1993	Led demonstration project team for the National Initiative for Product Data Exchange to produce proof-of-concept demonstrations showing how the National Information Infrastructure can be used to automate the brokering of electronic component information.
FY 1994	Continued to lead the Electronic Business Reply Card demonstration team, demonstrated software at CALS Expo, November 1993; Investigated use of

World Wide Web server and Mosaic client for electronic distribution of the NIST storeroom catalog; Suggested improvements to Internet protocols at the Federal Mosaic Consortium.

FY 1995 Initiated and supported the creation of a Python Software Association to support all industries which use Python programming language.

FY 1996 Completed prototype electronic component dictionary browser and search engine for on-line parts dictionaries; Developed an advanced object oriented dictionary prototype.

FY 1997 Develop an Object Oriented Printed Circuit Repository specification (this would allow the transfer of intelligent object-oriented electronic product descriptions and support querying of these objects); Develop a specification for a Product Information Viewer and its interface to the World Wide Web.

FY 1998 Conclude the development of a printed circuit repository with published specification of operation and demonstration model; Develop a process model to allow electronic commerce to be incorporated into an electronic product life-cycle development process; Develop a working simulation of the printed circuit repository on the virtual factory floor.

FY 1999 Conclude development of process model for electronic commerce and publish report.

3. Provide support for the SEMATECH Computer Integrated Manufacturing Framework

FY 1994 Completed first year report to SEMATECH analyzing and documenting cost of certification and conformance testing for computer integrated manufacturing framework to be 27 to 30 work-years.

FY 1995 Developed and documented technical and business model definitions for certification and conformance testing (these models included, for example, plans for how the test suite would be generated, distributed, and executed, and who would pay for certification, maintenance, and dispute resolution).

FY 1996 Developed prototype semi-automated test generator approach; Refined technical and business model definitions; Concluded phase I of task with report to SEMATECH.

FY 1997 Complete development of a prototype testing environment for the SEMATECH CIM framework, based on the Common Object Request Broker Architecture (CORBA) and the Java programming language, and publish a report documenting the work.

4. Develop prototype framework to integrate design tools for Microwave and Millimeter-wave Advanced Computational Environment program

FY 1993 Organized and conducted four-day technical meeting to discuss MMACE requirements; Converted supporting documents to World Wide Web format for interactive electronic distribution.

FY 1994 Developed Python language module to simplify creation of Common Gateway Interface (CGI) scripts for implementation of a control panel for the advanced computations environment on the World Wide Web.

FY 1995 Acted as Contracting Officers' Technical Representative, guiding two software developers in creating the final control panel; Completed control panel demonstrated; Investigated Khoros and Fresco programming languages for use in this application.

FY 1996	Finalized creation of industry-supported Python Software Association to support use of Python in this computational environment; Task completed.
FY 1997	Provide additional technical guidance related to the use of object oriented software for the MMACE framework as requested.